



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.09.2011 Bulletin 2011/36

(51) Int Cl.:
F02M 61/16 (2006.01) F02M 51/06 (2006.01)

(21) Application number: **10001954.6**

(22) Date of filing: **25.02.2010**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

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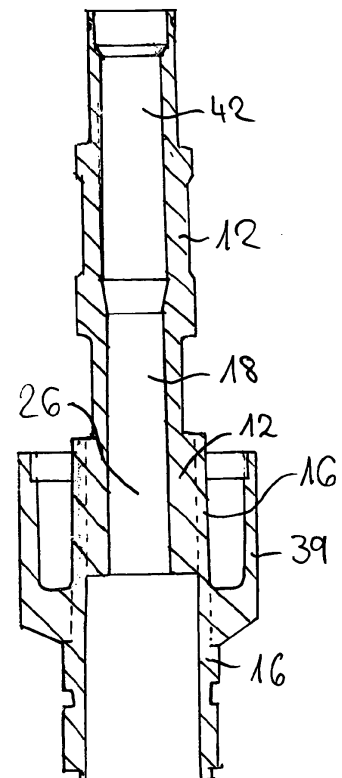
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(54) **Valve assembly for an injection valve and injection valve**

(57) The invention relates to a valve assembly for an injection valve and to an injection valve.

Valve assembly (11) for an injection valve (10), comprising an inlet tube (12), a valve body (14) including a central longitudinal axis (L), a valve body shell (16) being arranged radially outside the valve body (14) and the inlet tube (12) and being designed to mechanically couple the valve body (14) to the inlet tube (12), wherein the inlet tube (12), the valve body (14), and the valve body shell (16) comprise a common cavity (18) with a fluid inlet portion (42) and a fluid outlet portion (40), a valve needle (20) axially movable in the cavity (18), the valve needle (20) preventing a fluid flow through the fluid outlet portion (40) in a closing position and releasing the fluid flow through the fluid outlet portion (40) in further positions, and a housing (39) being designed to take up an actuator unit (36) for the actuation of the valve needle (20). The inlet tube (12), the valve body shell (16) and the housing (39) are formed as a one-piece part.

Fig. 2



Description

[0001] Valve assembly for an injection valve and injection valve

[0002] The invention relates to a valve assembly for an injection valve and to an injection valve.

[0003] Injection valves are in wide spread use, in particular for internal combustion engines where they may be arranged in order to dose the fluid into an intake manifold of the internal combustion engine or directly into the combustion chamber of a cylinder of the internal combustion engine.

[0004] Injection valves are manufactured in various forms in order to satisfy the various needs for the various combustion engines. Therefore, for example, their length, their diameter and also various elements of the injection valve being responsible for the way the fluid is dosed may vary in a wide range. In addition to that, injection valves may accommodate an actuator for actuating a needle of the injection valve, which may, for example, be an electromagnetic actuator or a piezo electric actuator.

[0005] In order to enhance the combustion process in view of the creation of unwanted emissions, the respective injection valve may be suited to dose fluids under very high pressures. The pressures may be in case of a gasoline engine, for example, in the range of up to 200 bar and in the case of diesel engines in the range of up to 2000 bar.

[0006] The object of the invention is to create a valve assembly and an injection valve which can be manufactured easily and with low costs.

[0007] These objects are achieved by the features of the independent claims.

[0008] According to a first aspect the invention is distinguished by a valve assembly for an injection valve, comprising an inlet tube, a valve body including a central longitudinal axis, a valve body shell being arranged radially outside the valve body and the inlet tube and being designed to mechanically couple the valve body to the inlet tube. The inlet tube, the valve body and the valve body shell comprise a common cavity with a fluid inlet portion and a fluid outlet portion. The valve assembly comprises a valve needle axially movable in the cavity. The valve needle prevents a fluid flow through the fluid outlet portion in a closing position and releases the fluid flow through the fluid outlet portion in further positions. The valve assembly further comprises a housing being designed to take up an actuator unit for the actuation of the valve needle. The inlet tube, the valve body shell and the housing are formed as a one-piece part.

[0009] This has the advantage that the number of components of the valve assembly can be kept small. Furthermore, the number of processing steps during the manufacturing of the valve assembly can be kept small. Additionally, laser welding, in particular hermetical welding, for the assembly of the inlet tube, the valve body shell and the housing is not necessary. Therefore, the

costs for the manufacturing process can be kept small. The one-piece-part of the inlet tube, the valve body shell and the housing can be manufactured by a metal injection molding process or a high density sintering process and the number of machining process steps can be kept small. Consequently, the valve assembly can be processed with low costs. Additionally, the one-piece-part of the inlet tube, the valve body shell and the housing enables an excellent magnetic flux distribution of the electro-magnetic actuator unit.

[0010] According to a second aspect the invention is distinguished by an injection valve with an actuator unit and a valve assembly according to the first aspect of the invention. The actuator unit is coupled to the valve assembly in a manner that the valve assembly is operable by the actuator unit.

[0011] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings. These are as follows:

Figure 1 an injection valve with a valve assembly in a longitudinal section view, and

Figure 2 an enlarged view of a longitudinal section of a part of the valve assembly.

[0012] Elements of the same design and function that appear in different illustrations are identified by the same reference character.

[0013] An injection valve 10 that is in particular suitable for dosing fuel to an internal combustion engine comprises in particular a valve assembly 11.

[0014] The valve assembly 11 comprises an inlet tube 12. Furthermore, the valve assembly 11 comprises a valve body 14 with a central longitudinal axis L and a valve body shell 16. The valve body shell 16 is arranged radially outside the valve body 14 and the inlet tube 12. The valve body shell 16 is mechanically coupling the valve body 14 to the inlet tube 12.

[0015] A common cavity 18 is arranged in the inlet tube 12, in the valve body 14 and in the valve body shell 16. The cavity 18 takes in a valve needle 20 and an armature 22. The valve needle 20 is axially movable in the cavity 18. The armature 22 is axially movable in the cavity 18.

[0016] A calibration spring 24 is arranged in a recess 26 which is provided in the inlet tube 12. The calibration spring 24 is mechanically coupled to the armature 22. The armature 22 forms a seat for the calibration spring 24.

[0017] The armature 22 has a recess 28. The valve needle 20 is in contact with an inner surface of the armature 22. The inner surface of the armature 22 can guide the valve needle 20 in the recess 28 of the armature 22 in axial direction.

[0018] A filter element 30 is arranged in the inlet tube 12 and forms a further seat for the calibration spring 24.

[0019] In a closing position of the valve needle 20 it sealingly rests on a seat plate 32 by this preventing a fluid flow through at least one injection nozzle 34. The

injection nozzle 34 may be, for example, an injection hole.

[0020] The injection valve 10 is provided with an actuator unit 36 that is preferably an electro-magnetic actuator. The electromagnetic actuator unit 36 comprises a coil 38, which is preferably arranged inside a housing 39 and is overmolded. Furthermore, the electro-magnetic actuator unit 36 comprises the armature 22. The inlet tube 12, the valve body shell 16, the housing 39 and the armature 22 are forming an electromagnetic circuit.

[0021] The cavity 18 has a fluid outlet portion 40 which is arranged near the seat plate 32. The cavity 18 has a fluid inlet portion 42 which is arranged in the inlet tube 12. The fluid outlet portion 40 is in hydraulic communication with the fluid inlet portion 42.

[0022] A step 44 is arranged in the valve body 14. An armature spring 46 is arranged in the cavity 18 axially between the step 44 of the valve body 14 and the armature 22. Preferably, the armature spring 46 is a coil spring. The armature spring 46 is supported by the step 44 in the valve body 14. The armature spring 46 forms a support element for the armature 22.

[0023] The inlet tube 12, the valve body shell 16 and the housing 39 are formed as a one-piece part. By this, the former three individual components inlet tube 12, valve body shell 16 and housing 39 are substituted by a single component. This has the advantage that the number of components of the valve assembly 11 and consequently, the total number of components of the injection valve 10 can be reduced.

[0024] Furthermore, the number of assembling steps in the manufacturing process can be limited. By this the costs of the injection valve 10 can be kept small.

[0025] The one-piece component of the inlet tube 12, the valve body shell 16 and the housing 39 can be manufactured by metal injection molding, high density sintering or partially by a machining process. Consequently, as no machining process or only a small amount of a machining process is necessary, the valve assembly can be manufactured with low costs. Furthermore, as the inlet tube 12, the valve body shell 16 and the housing 39 are forming a one-piece part, no laser welding between the single processes, in particular no hermetic welding, is necessary.

[0026] Furthermore, the one-piece part of the inlet tube 12, the valve body shell 16 and the housing 39 allows a very good magnetic flux distribution in the valve assembly 11 as there are no interfaces between the inner tube 12, the valve body shell 16 and the housing 39.

[0027] In the following, the function of the injection valve 10 is described in detail:

The fluid is led from the fluid inlet portion 42 through the filter element 30 in the recess 26 towards the fluid outlet portion 40.

[0028] The valve needle 20 prevents a fluid flow through the fluid outlet portion 40 in the valve body 14 in a closing position of the valve needle 20. Outside of the

closing position of the valve needle 20, the valve needle 20 enables the fluid flow through the fluid outlet portion 40.

[0029] In the case when the electro-magnetic actuator unit 36 with the coil 38 gets energized the actuator unit 36 may affect an electro-magnetic force on the armature 22. The armature 22 is attracted by the actuator unit 36 with the coil 38 and moves in axial direction away from the fluid outlet portion 40. The armature 22 takes the valve needle 20 with it via the armature spring 46. Consequently, the valve needle 20 moves in axial direction out of the closing position. Outside of the closing position of the valve needle 20 a fluid path between the valve body 14 and the valve needle 20 at the axial end of the injection valve 10 facing away from of the actuator unit 36 is formed and fluid can pass through the injection nozzle 34.

[0030] In the case when the actuator unit 36 is de-energized the calibration spring 24 can force the valve needle 20 to move in axial direction in its closing position. It is depending on the force balance between the force on the valve needle 20 caused by the actuator unit 36 with the coil 38 and the force on the valve needle 20 caused by the calibration spring 24 whether the valve needle 20 is in its closing position or not.

Claims

1. Valve assembly (11) for an injection valve (10), comprising

- an inlet tube (12),
- a valve body (14) including a central longitudinal axis (L),
- a valve body shell (16) being arranged radially outside the valve body (14) and the inlet tube (12) and being designed to mechanically couple the valve body (14) to the inlet tube (12), wherein the inlet tube (12), the valve body (14), and the valve body shell (16) comprise a common cavity (18) with a fluid inlet portion (42) and a fluid outlet portion (40),
- a valve needle (20) axially movable in the cavity (18), the valve needle (20) preventing a fluid flow through the fluid outlet portion (40) in a closing position and releasing the fluid flow through the fluid outlet portion (40) in further positions, and
- a housing (39) being designed to take up an actuator unit (36) for the actuation of the valve needle (20),

wherein the inlet tube (12), the valve body shell (16) and the housing (39) are formed as a one-piece part.

2. Injection valve (10) with an actuator unit (36) and a valve assembly (11) according to claim 1, wherein the actuator unit (36) is coupled to the valve assem-

bly (11) in a manner that the valve assembly (11) is operable by the actuator unit (36).

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Fig. 1

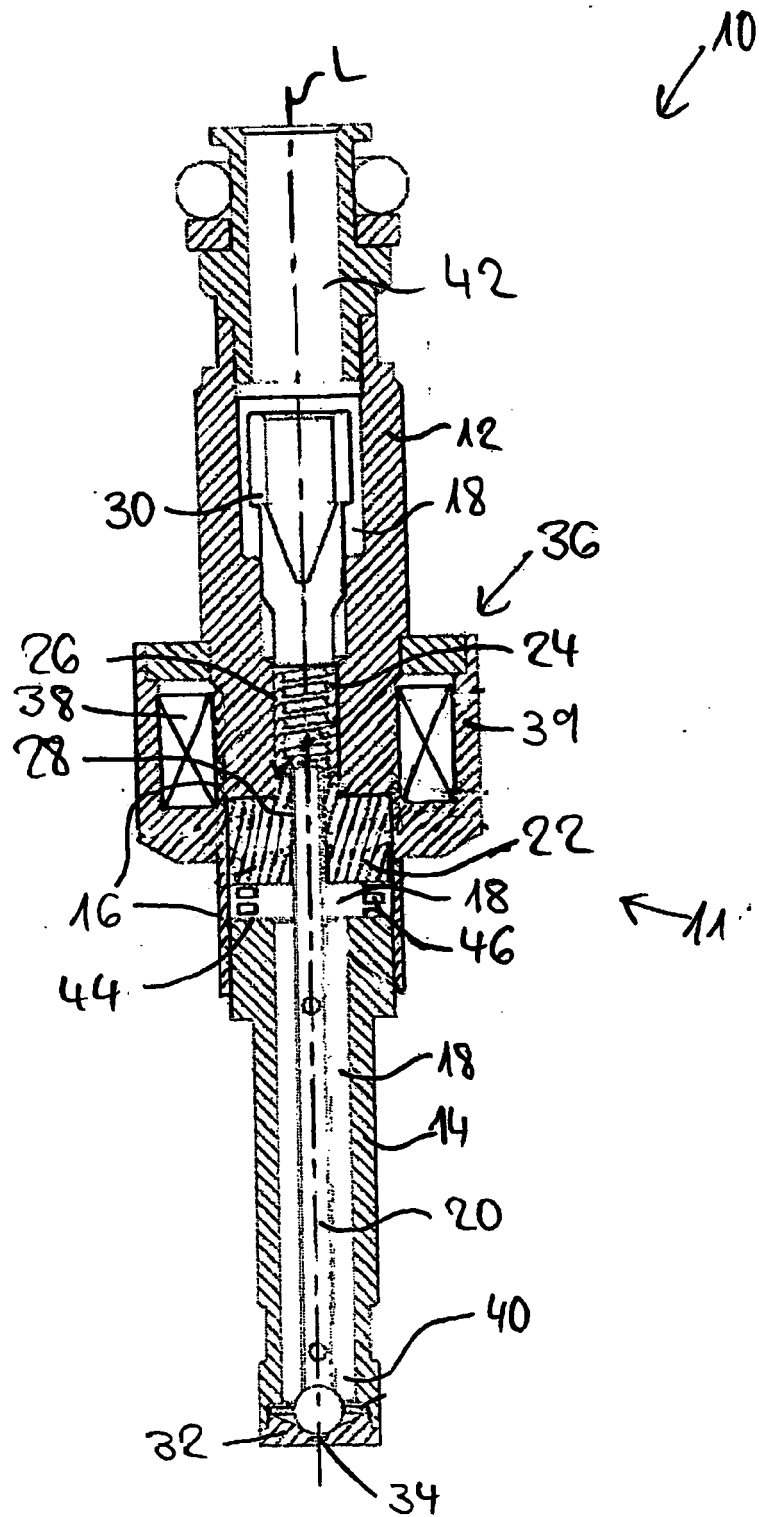
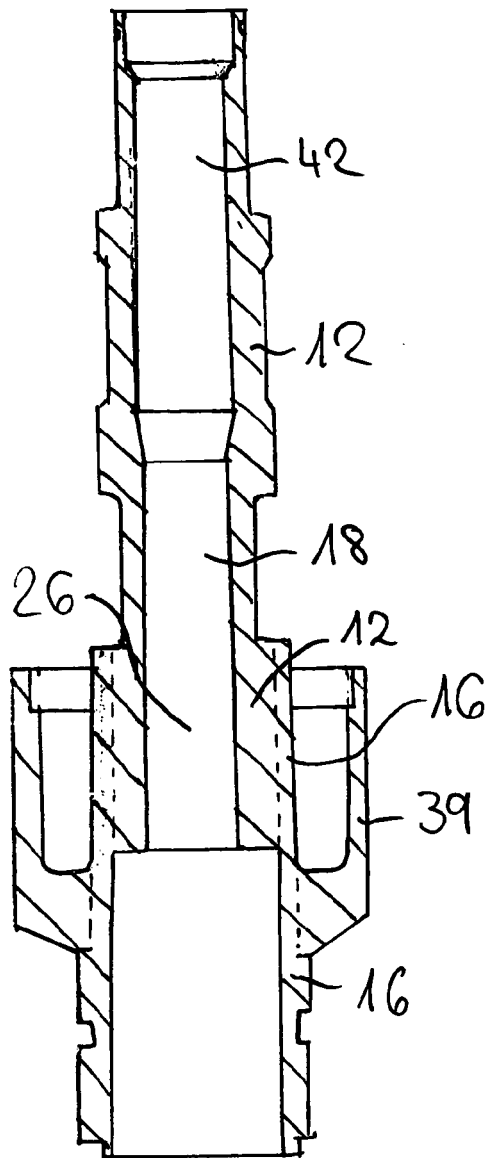


Fig. 2





EUROPEAN SEARCH REPORT

Application Number
EP 10 00 1954

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X	US 2005/133631 A1 (HORNBY MICHAEL J [US]) 23 June 2005 (2005-06-23) * paragraphs [0016], [0017]; figures 1,2 * -----	1,2	
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 August 2010	Examiner Kolland, Ulrich
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 10 00 1954

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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